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NEW RECORDS FOR RARE AND UNDER-COLLECTED AQUATIC VASCULAR PLANTS OF YELLOWSTONE NATIONAL PARK

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ABSTRACT

During 2008 and 2010, we conducted a floristic inventory of the aquatic vascular plants of Yellowstone National Park (YNP). Here, we report noteworthy records found during a survey of over 224 collecting locations within YNP. We documented 26 noteworthy species from 151 collections. These records represent rare, under-collected or newly located species in YNP, Montana, and Wyoming. New records include members of the Araceae (incl. Lemnaceae), Haloragaceae, Hydrocharitaceae, Isoëtaceae, Lentibulariaceae, Potamogetonaceae, and Typhaceae (incl. Sparganiaceae). During our fieldwork, we located two species new to Montana (*Myriophyllum quitense* and *Potamogeton strictifolius*) and three species new to Wyoming (*Isoëtes echinospora*, *Najas flexilis*, and *Utricularia ochroleuca*). We also found a single location for *P. obtusifolius*, a species known historically from Wyoming. In addition, we located *P. zosteriformis*, a species that had not been collected recently in Wyoming. We also found several species that were either new to the flora of YNP (*Callitriche heterophylla*, *N. flexilis*, *Potamogeton obtusifolius*, *P. zosteriformis*) or species previously collected in YNP, but were misidentified in herbarium records (*Lemna gibba*, *P. strictifolius*, *Stuckenia vaginata*, and *U. ochroleuca*). Our work also has greatly augmented the known collections of additional rare species in the Greater Yellowstone Ecosystem such as *Lemna valdiviana*, *M. verticillatum*, *P. amplifolius*, *P. friesii*, *P. robbinsii*, and *U. minor*. In addition, we found new sites for infrequently encountered or easily overlooked aquatic species including *Ceratophyllum demersum* (Ceratophyllaceae), *Elatine rubella* (Elatinaceae), *Elodea nuttallii* (Hydrocharitaceae), *Ruppia cirrhosa* (Ruppiaceae), and *Subularia aquatica* (Brassicaceae).

Key Words: Aquatic vascular plants, *Myriophyllum*, *Potamogeton*, *Potamogeton foliosus* subsp. *fibrillosus*, *Utricularia*, Yellowstone National Park.

Yellowstone National Park (YNP) covers 8987 km^2 and has been shaped by geological forces dominated by uplift of mountains, volcanism, and glaciation (Marston and Anderson 1991). Much of the landscape of YNP is characterized by aquatic habitats. YNP contains the headwaters of the Missouri-Mississippi and Snake-Columbia watersheds (Marston and Anderson 1991). Approximately 5% (ca. 46,000 ha) of the surface area of YNP is covered by water (Varley and Schullery 1998). Much of this water is distributed across 150 lakes, with Yellowstone Lake being the largest high elevation lake in North America (Varley and Schullery 1998). In addition to the wealth of lakes in YNP, over 500 streams with a total length of over 4000 km drain the watersheds of YNP (Varley and Schullery 1998). Along with the abundant aquatic ecosystems of YNP, the park also has extensive wetlands. Many YNP wetlands are hydrothermally influenced, thus creating a complex chemical environment that affects the abundance and distribution of wetland and aquatic vegetation. The wide variety of aquatic and semi-aquatic habitats distributed across the geologically complex landscape of YNP provides an ideal setting to examine patterns of aquatic plant distribution, abundance, and habitat characteristics.

There are approximately 1150 native vascular plant species in Yellowstone National Park (Young 2007) and approximately 2082 in the Greater Yellowstone Ecosystem (GYE) (Evert 2010). Of these species, a proportionally small (ca. 9% YNP, ca. 5% GYE), but ecologically important number of these plants are aquatic. Hydrophytes grow in or on water and may be anchored to inundated or saturated sediments for some period of the growing season (Tiner 2012). Hydrophyte biomass may be entirely submerged or may be a combination of submerged, floating, and emergent. Hydrophytes are classified as obligate indicators of aquatic or wetland conditions (Lichvar et al. 2012).

Ecologically, hydrophytes are important food for waterfowl (Fassett 1957) and provide habitat for fish that is used for nesting, egg attachment, and refuge (Sculthorpe 1967; Mulligan 1969). In addition, aquatic plants oxygenate water, reduce currents, shade and cool littoral sediments, promote sedimentation and retention, add organic matter to sediments, and provide habitat heterogeneity and substrate for aquatic vertebrates, invertebrates, and periphyton (Mulligan 1969). Despite their importance to aquatic ecosystems, aquatic plants are often underrepresented in herbarium collections and floras.

Yellowstone National Park has a long history of plant exploration (e.g., Tweedy 1886; Rydberg 1900), but aquatic plants have been undercollected. Species collected in this study have probably existed for many years in YNP and are not new introductions. Many taxa occur in neighboring regions or states and thus YNP records are likely filling gaps within ranges that are more contiguous than previously realized. In addition, several are small species that are easily overlooked. Below, we provide comments on overlooked species or noteworthy additions to the aquatic vascular flora of YNP, the GYE, as well as Montana, Wyoming, and Idaho.

METHODS

In 2008 and 2010, we conducted an inventory of the aquatic vascular flora of YNP to thoroughly document species occurrences, while also linking patterns in water chemistry to the abundance and distribution of aquatic vascular plants. The project also entailed use of the Yellowstone National Park Herbarium (YELLO) and the Rocky Mountain Herbarium (RM) to locate previous collections and to annotate specimens as needed. During early July to mid-August, we sampled YNP ponds, lakes, rivers, and wetlands focused specifically on aquatic plant diversity. Surveys took place via shoreline wading or by canoe. Over the two summers, we surveyed more than 224 YNP collection sites. Specimens for herbarium collections were collected by hand or by grapple. We collected all aquatic vascular species that we could locate at each site. Water chemistry parameters at sampling locations (pH, alkalinity, conductivity, nitrates, phosphorus, and trace metals) were measured and will be presented elsewhere (Hellquist et al., unpublished data).

Unless otherwise noted, species determinations were made by C. B. Hellquist and C. E. Hellquist. Collections of the Lentibulariaceae were annotated by Garrett E. Crow (University of New Hampshire, Durham, NH) and Barry Rice (The Nature Conservancy, Davis, CA). James Hickey (University of Miami, Oxford, OH) annotated the Isoëtaceae. Donald Les (University of Connecticut; DNA analysis of *Elodea* Michx.) and Zdenek Kaplan and Judith Fehrer (Academy of Sciences of the Czech Republic; DNA analysis of *Potamogeton* L. and *Stuckenia* Börner) determined problematic collections with DNA analysis. Collections confirmed with DNA fingerprinting are noted with "DNA" following the date in the collection citations. Nomenclature follows Haynes (2000a) for the Hydrocharitaceae, Taylor et al. (1993) for the Isoëtaceae, Haynes and Hellquist (2000) for the Potamogetonaceae, Kaul (2000) for the Sparganiaceae, Landolt (2000) for the Lemnaceae, Les (1997) for the Ceratophyllaceae, and Crow and Hellquist (2000) for the Brassicaceae, Elatinaceae, Haloragaceae, Lentibulariacae, and Plantaginaceae. Global and Subnational Ranks are cited from NatureServe (2012). State Heritage Ranks and species of concern recognition are cited from the Wyoming Natural Diversity Database (Heidel 2012).

RESULTS AND DISCUSSION

We located a variety of noteworthy records for aquatic plants that were either new locations of state species of concern, new records for Wyoming or Montana, new records for YNP, undercollected species, or a combination of these categories. We documented 102 aquatic vascular plant species and hybrids, and collected over 2200 dried specimens of aquatic or other wetland plants (Hellquist et al., unpublished data). These specimens are deposited in the Yellowstone National Park Herbarium (YELLO), Yellowstone Heritage and Research Center, Gardiner, MT. Below, we summarize notable members of the YNP aquatic vascular flora that are either listed as species of concern by their respective states or are uncommon or under-collected members of the aquatic flora of YNP.

ARACEAE (INCLUDING LEMNACEAE)

Lemna gibba L.

Lemna gibba (swollen duckweed) is found in quiet, eutrophic habitats (Landolt 2000) and has distinctive inflated fronds that can be confirmed in cross section (Dorn 1984). *Lemna gibba* is found in Eurasia, South America, northern México, and Africa. In North America, its range is most contiguous from Texas to California and Nevada. Scattered stations are located in Illinois, Nebraska, and the GYE (Landolt 2000). Dorn (1984, 2001) states that *L. gibba* is reported from Montana and Wyoming, respectively, but no location information is provided. Evert (2010) doubts that *L. gibba* is native to GYE. Tweedy (1886) noted that *L. gibba* is rare in YNP and cites its presence in ponds near the head of Broad Creek. In 1979, *L. gibba* was collected in a marshy pond along the Specimen Ridge Trail between Soda Butte Creek and the Lamar River (*T. Caprio 706* [YELLO]). In addition, Kesonie and Hartman (2011) report two collections from Grand Teton National Park and John D. Rockefeller Parkway. We found *L. gibba* in two quiet ponds in the Mammoth-Gardiner vicinity of YNP.

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Ice Lake, "Landslide Lake," at Gardiner Basin, first lake upstream along Landslide Creek, ca. 1.0 mile from road, elev. 5487 ft, 45°01.993′N, −110°45.023′W, 9 July 2007, *C. E. Hellquist and C. B. Hellquist 16-08*; Sixth pond, the largest along Beaver Pond Trail Loop at the northeast corner of the loop, starting at the west end from Mammoth Hot Springs, elev. 6518 ft, 44°59.950′N, −110°43.117′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 830-10.*

Lemna valdiviana Philippi

Lemna valdiviana (small duckweed) is a widespread duckweed found in South America, Central America, North America, and the West Indies (Landolt 2000). In western North America, *L. valdiviana* is found in several isolated sites, with most locations concentrated along the Atlantic coast, the lower Mississippi Valley, and the Gulf of México (Landolt 2000). Fronds of *L. valdiviana* tend to be somewhat elongate and have a midvein that ends just short of the frond apex at least three quarters from the node.

Although not mapped by Landolt (2000) from the GYE it is recorded from Park and Teton Counties in Wyoming (Dorn 2001; Evert 2010). This species is of concern in Wyoming (G5/S1). Evert (2010, p. 401) describes the species as "rare" and typical of quiet waters including warm springs between 3800–8200 ft in elevation. In YNP, *Lemna valdiviana* has been collected in the Bechler District in the Robinson Creek thermal area from a warm spring discharge (*J. J. Whipple 3488* [YELLO]). Our single collection was in a small thermally influenced seep on the west bank of the Firehole River near Ojo Caliente Spring.

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Spring seep above Firehole River north of Ojo Caliente Spring, elev. 7203 ft, 44°33.927′N, −110°50.654′W, 19 July 2010, *C. E. Hellquist and C. B. Hellquist 756-10.*

BRASSICACEAE

Subularia aquatica L.

Subularia L. (awlwort) is one of five genera of the mustard family that have aquatic or semi-aquatic species. There are only two species of *Subularia* worldwide, with *S. aquatica* the only North American species (Al-Shehbaz 2010). Awlwort is found entirely submerged in shallow waters or emergent in littoral zones of freshwater or saline wetlands (Al-Shehbaz 2010). *Subularia* is an annual with a basal rosette of tapered, quill-like leaves that can be inconspicuous in the field. *Subularia* is found widely distributed primarily in northern states and provinces in North America (Al-Shehbaz 2010). In the western United States, *Subularia* is found in Wyoming, Utah, Colorado, Idaho, Washington, and California (Al-Shehbaz 2010). In YNP, *Subularia* was found in a small pond at the outlet of Yellowstone Lake (Tweedy 1886) and from an 1873 collection at Lake (Rydberg 1900). Mulligan and Calder (1964) map a *Subularia* collection from Yellowstone Lake and from sites in Fremont and Sublette Counties, Wyoming. Evert (2010, p. 238) stated that *Subularia* is "rare, seldom seen or collected" in the region. *Subularia* has been collected in YNP from the Bechler District ("Boundary Lake #2"), which is probably located along the west boundary of YNP near Boundary Creek (*B. Gresswell s.n.*, det. by D. Despain [YELLO 4467]). Additional YNP *Subularia* sites include Scaup Lake (*J. J. Whipple 2946* [YELLO]) and Plover Point, Yellowstone Lake (*J. J. Whipple 5753* [YELLO]).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Pond on the west side of Grebe Lake Trail, ca. 1.25 miles north of Norris-Canyon Rd, elev. 8140 ft, 44°43.708′N, −110°32.099′W, 30 July 2010, *C. E. Hellquist and C. B. Hellquist 883-10.* **Teton Co.:** Lewis River, north of Lewis Lake, downstream of fast water, elev. 7782 ft, 44°19.804′N, 110°38.749′W, 9 Aug 2009, *C. E. Hellquist and C. B. Hellquist 524-08*; Mallard Lake east of Old Faithful, elev. 8054 ft, 44°28.555′N, −110°46.480′W, 14 Aug 2010, *C. E. Hellquist, C. B. Hellquist, and X. Vu 1094-10*; Marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist, and H. Anderson 1126-10.*

CERATOPHYLLACEAE

Ceratophyllum demersum L.

Ceratophyllum demersum (Hornwort) is a floating species that lacks roots and rarely produces flowers and fruit. *Ceratophyllum* L. is widely disjunct from eastern North America to Washington, Oregon, and interior British Columbia (Les 1997). In YNP, *C. demersum* is found in the quiet waters of lakes and ponds primarily in the Northern Range. *Ceratophyllum demersum* is one of the most widespread aquatic plants in North America (Les 1997), but we found it in only six sites in YNP. Evert (2010, p. 267) notes that *C. demersum* is found in a variety of habitats but "seldom seen or collected in our area". Interestingly, Tweedy (1886) states that *Ceratophyllum* is often seen in "great quantities" (p. 19) and is "frequent in sluggish streams and lake sloughs throughout up to 8500 ft alt" (p. 62). However, Rydberg (1900) only cites one collection of *Ceratophyllum* from YNP at Broad Creek. Herbarium specimens of *C. demersum* have been collected at Lost Lake (*H. S. Conard 1237* [YELLO]), Cygnet Lakes (*B. Gresswell s.n.* [YELLO]), Fern Lake (*USFWS s.n.* [YELLO 5655]), eastern White Lake (*USFWS s.n.* [YELLO 5656]), and an unnamed lake associated with a tributary of Rescue Creek (*Gresswell s.n.* [YELLO 4603]). This collection (YELLO 4603) is a mixed collection with *Myriophyllum verticillatum.*

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Landslide Lake ("Ice Lake"), at Gardiner Basin, first lake upstream along Landslide Creek, ca. 1.0 mile from road, elev. 5487 ft, 45°01.993′N, −110°45.023′W, 9 July 2007, *C. E. Hellquist and C. B. Hellquist 15a-08*; Slide Lake, Gardiner Basin along Old Gardiner Rd, elev. 5723 ft, 45°00.301′N, −110°42.001′W, 9 July 2008, *C. E. Hellquist and C. B. Hellquist 5-08*; Lower Rainbow Lake at Gardiner Basin, south of Old Gardiner Rd, elev. 5876 ft, 45°01.444′N, −110°44.621′W, 29 Aug 2008, *C. E. Hellquist and C. B. Hellquist 293-08*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Lost Lake, west of Roosevelt Lodge. Deep lake fringed with *Nuphar*. elev. 7041 ft, 44°54.560′N, −110°25.665′W, 11 July 2008, *C. E. Hellquist and C. B. Hellquist 34-08*; Blacktail Pond east of Mammoth, Blacktail Deer Plateau, Mammoth-Tower Rd, elev. 6643 ft, 44°57.264′N, −110°36.215′W, 25 July 2008, *C. E. Hellquist and C. B. Hellquist 224-08*. **Teton Co.:** Old marina, Yellowstone Lake at Grant Village, elev. 7732 ft, ca. 44°23.607′N, −110°33.234′W, 20 Aug 2010, *C. E Hellquist and M. T. Hellquist 1141-10.*

ELATINACEAE

Elatine rubella Rydb.

Elatine L. (waterwort) was found in two sites in YNP. *Elatine* can grow interspersed with other small, submerged species in shallow water or emergent on exposed mud. By rooting at its nodes it can form small patches or mats. In YNP, we found *Elatine* in marshy, littoral habitats.

Confusion regarding the taxonomy of *E. americana* (Pursh) Arn., *E. brachysperma* A. Gray, *E. rubella, E. triandra* Schkuhr, and *E. triandra* var. *brachysperma* (A. Gray) Fassett is reflected in the literature. *Elatine rubella* is the oldest recognized name for this group of *Elatine* in North America (Holmgren et al. 2005). Sometimes referred to as *E. triandra* (Evert 2010), Dorn (2001) stated that *E. rubella* was the only species in Wyoming. Tweedy (1886) cited collections of *E. americana* and *E. triandra* from Yellowstone Lake. In 1900, Rydberg recognized what had previously been referred to as *E. americana,* as *E. rubella. Elatine rubella* was considered a new species found along Yellowstone Lake in volcanic sands. Rydberg acknowledged that *E. rubella* was very similar to the previously described *E. americana* and that it may be closely related. Today, *E. americana* is recognized as having an eastern distribution with its westernmost stations in Missouri and Oklahoma (Crow and Hellquist 2000).

Elatine rubella and *E. brachysperma* are both rare in the GYE (Evert 2010). *Elatine brachysperma* is known from a single 1933 collection in Hebgen Lake in the GYE (Evert 2010) but is not known from YNP or Wyoming. *Elatine rubella* and *E. brachysperma* can be distinguished based on the amount of seed pits on the surface of the seeds. *Elatine rubella* has seeds with 16–25 pits per row while *E. brachysperma* has seeds with 9–15 pits per row (Crow and Hellquist 2000).

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Gallatin Co.:** Divide Lake along east side of Gallatin Rd, north of West Yellowstone, elev. 7252 ft, 44°54.641′N, −111°03.061′W, 6 Aug 2008, *C. E. Hellquist and C. B. Hellquist 447-08*. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist and H. Anderson 1124*; Marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist and H. Anderson 1125.*

HALORAGACEAE

Myriophyllum quitense Kunth

Myriophyllum quitense (Andean water-milfoil) initially appears similar to the widespread and common *M. sibiricum* Kom. It has bright green foliage that appears stiff and rough when held out of water. When fertile, *M. quitense* produces large floral bracts that easily distinguish it from *M. sibiricum*, which produces minute bracts (see key in Ceska et al. 1986). *Myriophyllum quitense* has an unusual disjunct geographic distribution with populations in South America and North America. In North America, *M. quitense* is found in México, the western United States (Arizona, Montana, Oregon, Washington, and Wyoming) and eastern Canada (Prince Edward Island, New Brunswick; Ceska et al. 1986; McAlpine et al. 2007; Lesica 2012). *Myriophyllum quitense* has been considered both native (Ceska et al. 1986; McAlpine et al. 2007) and introduced (Aiken 1981; Couch and Nelson 1988) in North America.

Myriophyllum quitense is a species of concern in Wyoming (G4?/S1) and has been recorded in YNP since the late 1800's with the apparent first record collected in 1885 by F. Tweedy from Yellowstone Lake (Couch and Nelson 1988). Another early record was an 1899 collection by A. and E. Nelson (*A. Nelson 6791* [RM]) collected from the "Madison River 3 miles from R.S.". In Nelson's notes, *M. quitense* was described as being abundant in slow moving water of rivers and bays. "R.S." is likely the Riverside Station that was located 3–4 miles west of Seven Mile Bridge, but it is unclear in what direction from Riverside Station the collection was made. The site is likely in Wyoming, but it could also have been Montana. Records of *M. quitense* from the early 1900's were collected by Jepson from the Firehole River and by M. E. Jones from Swan Lake (Couch and Nelson 1988). *Myriophyllum quitense* was collected in 1953 in the Madison River west of Madison Junction (*Porter 6379* [RM]). In 1965, *M. quitense* was collected in the Firehole River in the Lower Geyser Basin (*Hitchcock 23891* [RM]). In the 1990's, additional collections of *M. quitense* were made in the Firehole River upstream of the Ojo Caliente Bridge (*J. J. Whipple 4136* [YELLO]) and in Nez Perce Creek just upstream of the bridge on the Grand Loop Rd (*J. J. Whipple 4200* [YELLO]). The Firehole River and Nez Perce sites were still thriving populations in 2010.

We found *M. quitense* in the Falls, Firehole, Madison, Snake, and Lewis Rivers as well as Nez Perce and Fairy Creeks. The most extensive stands of *M. quitense* in YNP were in cold, shallow currents of the Firehole and Madison Rivers as well as Nez Perce Creek. Along the Firehole River and Nez Perce Creek, we found *M. quitense* in areas with hydrothermal influence. In a few instances, we found *M. quitense* in slow moving waters such as within Lewis River. The records of *M. quitense* in the Madison River just inside the YNP boundary, and just outside of YNP at Baker's Hole, are the first records for the species in Montana (S. Mincemoyer, personal communication).

Rydberg (1900) noted that *Myriophyllum spicatum* L., an introduced species, was present in the Madison River in Montana based on 1886 collections by Tweedy. We have not seen these specimens, but based on the present occurrence of *M. quitense* and *M. sibiricum* in the Madison River, it is unlikely these collections were *M. spicatum*. *Myriophyllum sibiricum* is the most abundant water-milfoil in YNP and we believe the Tweedy collections are likely either *M. sibiricum* or *M. quitense*. Locating any aquatic invasive species was a focus of our work. We looked thoroughly for *M. spicatum* and we did not find it in YNP, although the range of *M. spicatum* is approaching the GYE.

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Gallatin Co.:** Madison River north of West Yellowstone, east of USFS Baker's Hole Campground along west boundary of the park, elev. 6591 ft, 44°42.211′N, −111°05.719′W, 5 Aug 2008, *C. E. Hellquist and C. B. Hellquist 434-08*; Madison River on north side of West Yellowstone–Madison Jct Rd, just east of park entrance, elev. 6665 ft, 44°40.013′N, −111°04.075′W, 6 Aug 2008, *C. E. Hellquist and C. B. Hellquist 457-08*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Washed ashore on north end of Yellowstone Lake, east of Pelican Creek and east of Fishing Bridge, elev. 7736 ft, 44°33.161′N, −110°21.108′W, 11 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1034-10*; Yellowstone River between Buffalo Ford and Nez Perce Ford, north of Fishing Bridge, elev. 7708 ft, ca. 44°37.093′N, −110°25.096′W, 12 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1058-10*; Yellowstone River at "Grizzly Curve" Hayden Valley, Canyon-Lake Rd, elev. 7680 ft, ca. 44°39.256′N, −110°27.809′W, 12 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1068-10*; Yellowstone River at Alum Creek, Hayden Valley, Canyon-Lake Rd, elev. 7664 ft, ca. 44°40.552′N, −110°29.193′, 14 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1080-10*. **Teton Co.:** Small backwater of Snake River at Snake River picnic area at trailhead at the South Boundary Ranger Station, elev. 6917 ft, 44°08.173′N, −110°39.933′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 261-08*; Lewis River backwater on east side of main channel at confluence with Snake River, elev. 6871 ft, 44°08.173′N, −110°39.933′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 277-08*; Firehole River south of Old Faithful and Upper Geyser Basin, elev. 7433 ft, 44°27.388′N, −110°49.257′W, 30 July 2008, *C. E. Hellquist, C. B. Hellquist and J. J. Whipple 312-08*; Firehole River, Upper Geyser Basin below Old Faithful Inn, south of bridge to Geyser Hill, elev. 7390 ft, ca. 44°27.708′N, −110°49.581′W, 30 July 2008, *C. E. Hellquist, C. B. Hellquist and J. J. Whipple 316-08*; Firehole River north of Upper Geyser Basin from Artemisia Geyser to Biscuit Basin, elev. 7284 ft, 44°28.865′N, −110°51.057′W, *C. E. Hellquist, C. B. Hellquist and J. J. Whipple 326-08*; Nez Perce Creek, warmed by thermal activity, east of Madison-Old Faithful Rd, elev. 7146 ft, 44°34.377′N, −110°49.106′W, 31 July 2008, *C. E. Hellquist and C. B. Hellquist 333-08*; Firehole River, warmed by thermal activity upstream, at Fountain Flats Drive, west of Ojo Caliente Hot

Springs along Madison-Old Faithful Rd; elev. 7199 ft, 44°34.146′N, −110°50.065′W, 31 July 2008, *C. E. Hellquist and C. B. Hellquist 345-08*; Nez Perce Creek between Nez Perce Picnic Area and confluence with Firehole River, elev. 7191 ft, 44°34.782′N, −110°49.906′W, 31 July 2008, *C. E. Hellquist and C. B. Hellquist 350-08*; Firehole River at confluence with Nez Perce Creek just north of Nez Perce Picnic Area, elev. 7161 ft, 44°34.861′N, −110°50.001′W, 1 Aug 2008, *C. E. Hellquist and C. B. Hellquist 358-08*; Firehole River on east side of Ojo Caliente Bridge and Ojo Caliente Spring, Fountain Flats, elev. 7183 ft, 44°33.768′N, −110°50.312′W, 4 Aug 2008, *C. E. Hellquist and C. B. Hellquist 405-08*; Firehole River south of Firehole Picnic Area along Madison Jct.–Old Faithful Rd, elev. 7159 ft, 44°35.625′N, −110°49.974′W, 4 Aug 2008, *C. E. Hellquist and C. B. Hellquist 409-08*; Madison River south of West Yellowstone–Madison Jct Rd at Harlequin Lake Trailhead, elev. 6810 ft, 44°38.290′N, −110°53.306′W, 5 Aug 2008, *C. E. Hellquist and C. B. Hellquist 425-08*; Lewis River, north of Lewis Lake, downstream of fast water, elev. 7782 ft, 44°19.804′N, −110°38.749′W, 9 Aug 2009, *C. E. Hellquist and C. B. Hellquist 526-08*; Lewis River ca. 0.5 mile south of Lewis Falls along Grant - South Entrance Rd, elev. 7759 ft, 44°15.586′N, −110°38.382′W, 11 Aug 2009, *C. E. Hellquist and C. B. Hellquist 569-08*; Madison River backwater, east of Seven Mile Bridge along Madison-West Yellowstone Rd, elev. 6770 ft, ca. 44°39.622′N, −110°57.770′W, 14 Aug 2008, *C. E. Hellquist and C. B. Hellquist 594-08*; Firehole River north of Ojo Caliente Springs, elev. 7203 ft, 44°33.927′N, −110°50.654′W, 19 July 2010, *C. E. Hellquist and C. B. Hellquist 752-10*; Fairy Creek at confluence with Firehole River near Ojo Caliente Springs, elev. 7204 ft, 44°33.755′N, −110°50.473′W, 19 July 2010, *C. E. Hellquist and C. B. Hellquist 754-10*; Shore of Shoshone Lake near DeLacy Creek, fragments along shore, elev. 7791 ft, 44°24.587′N, −110°41.7895′W, 24 July 2010, *C. E. Hellquist and C. B. Hellquist 781-10*; West shore of Beula Lake at trails end, elev. 7411 ft, 44°09.2429′N, −110°46.0304′W, 28 July 2010, *C. E. Hellquist and C. B. Hellquist 837-10*; Falls River at South Boundary Trail ford, Bechler District, elev. 6225 ft, 44°08.211′N, −111°00.531′: 6 Aug 2010, *C. E. Hellquist and C. B. Hellquist 971-10*; Southeast shore of Lewis Lake, south of public launch site, elev. 7752 ft, 44°16.786′N, −110°37.903′W, 9 Aug 2010,. *C. E. Hellquist and C. B. Hellquist 1006-10.*

Myriophyllum verticillatum L.

Of the three *Myriophyllum* species in YNP *(M. quitense, M. sibiricum,* and *M. verticillatum), M. verticillatum* (whorl-leaf watermilfoil) is the least common. *Myriophyllum verticillatum* differs from *M. quitense* and *M. sibiricum* by producing larger numbers of leaflets on closely spaced internodes along the stem. When removed from the water, the leaves fall on each other giving the plant a soft, plush appearance. Later in the season, *M. verticillatum* forms pectinate bracts along its inflorescence and large club-shaped turions along the stem. We found *M. verticillatum* at seven sites throughout the park, typically in standing water.

Myriophyllum verticillatum is a species of concern in Wyoming (G5/S1). In YNP, specimens have been collected from Robinson Creek in Idaho (*J. J. Whipple 3468* [YELLO]), Harlequin Lake, (*Gresswell s.n. 6223* [YELLO]), Little Robinson Lake (*Gresswell s.n. 4616* [YELLO]), from a small lake on Mt. Everts (*Gresswell s.n. 4603* [YELLO]), and from ponds east of Twin Buttes (*E. F. Evert 39598* [RM]), *Myriophyllum verticillatum* was recorded from "lakes, head of Broad Creek" in YNP (Tweedy 1886, p. 38). In addition, a specimen was collected at a small pond near Norris Junction (*Porter 6376* [RM]).

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** First pond along Beaver Pond Trail Loop, starting at the west end from Mammoth Hot Springs. elev. 6841 ft, 44°59.661′N, −110°43.175′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 805-10*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Oxbow wetlands along Slough Creek near the junction of Slough Creek Campground and Tower – Lamar Rd, 44°55.597′N, −110°19.249′W, 13 July 2008, *C. E. Hellquist and C. B. Hellquist 53-08*; Glen Creek, east of parking lot for Bunsen Peak Trail, Swan Lake Flat, elev. 7296 ft, 44°55.923′N, −110°43.596′W, 15 July 2008, *C. E. Hellquist, C. B. Hellquist and S. Gunther 81-08,* 13 Aug 2008, *C. E. Hellquist and C. B. Hellquist 586-08*; Gibbon River west of Norris Picnic Area, elev. 7520 ft, 44°43.773′N, −110°41.365′W, 16 July 2008, *C. E. Hellquist and C. B. Hellquist 95-08*; Small pond south of Swan Lake, Swan Lake Flats, elev. 7288 ft, 44°54.830′N, −110°43.498′W, 22 July 2008, *C. E. Hellquist and C. B. Hellquist 161-08*; *Triglochin* marsh on west side of Norris – Madison Rd at the south end of Elk Park, elev. 7526 ft, 44°42.956′N, −110°43.572′W, 23 July 2008, *C. E. Hellquist and C. B. Hellquist 202-08*; North Twin Lake along Mammoth – Norris Rd, elev. 7574 ft, 44°46.511′N, −110°44.180′W, 7 Aug 2008, *C. E. Hellquist and C. B. Hellquist 464-08*. **Teton Co.:** Harlequin Lake north of West Yellowstone–Madison Jct Rd, elev. 6896 ft, 44°38.671′N, −110°53.575′W, 5 Aug 2008, *C. E Hellquist and C. B. Hellquist 417-08*; Southwesternmost pond north of trail to Nez Perce Patrol cabin, north of Nez Perce Creek, Madison-Old Faithful Rd, pond mostly filled with grasses and sedges, elev. 7220 ft, 44°34.632′N, −110°48.828′W, 17 July 2010, *C. E. Hellquist* *and C. B. Hellquist 704-10*; Middle pond north of trail to Nez Perce Patrol cabin, north of Nez Perce Creek, Madison-Old Faithful Rd, pond mostly filled with grasses and sedges. elev. 7224 ft, 44°34.754′N, −110°48.741′W, 17 July 2010, *C. E. Hellquist and C. B. Hellquist 720-10*; DeLacy Creek, at confluence with Shoshone Lake, elev. 7791 ft, 44°24.5878′N, −110°41.7895′W, 24 July 2010, *C. E. Hellquist and C. B. Hellquist 799-10*; South end of large pond at jct of Bechler Meadows Trail and Boundary Creek Trail, Bechler District, elev. 6475 ft, 44°10.033′N, −111°01.958′W, 5 Aug 2010, *C. E. Hellquist and C. B. Hellquist 964-10.*

HYDROCHARITACEAE

Elodea nuttallii (Planch.) H. St. John

Elodea nuttallii (waterweed) was found in sites in the central and southern regions of YNP associated with Yellowstone Lake as well as the Lewis, Snake, and Yellowstone Rivers. Previously, only *E. canadensis* Michx. was recognized within YNP (Evert 2010). Morphologically, our collections resembled *E. canadensis,* however DNA fingerprinting revealed the collections to be *E. nuttallii* (D. Les, personal communication). *Elodea nuttallii* is more prevalent in eastern North America and widely scattered in the west. *Elodea nuttallii* was last collected in the GYE in 1949 in Hebgen Lake, Gallatin CO, MT (Evert 2010). Ongoing molecular work on *Elodea* by D. H. Les is calling into question the determination of *Elodea* species based solely on vegetative morphology. Fertile material is recommended for accurate identification of *Elodea* due to the vegetative plasticity of taxa (D. H. Les, personal communication).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** East shore of Snake River, backwater in meadow along South Boundary trail, adjacent to hot spring channel, elev. 6887 ft, 44°08.068′N, −110°39.759′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 265-08*; Narrow cut-off channel of the Snake River along the South Boundary Trail, at the South Boundary Station, elev. 6917 ft, 44°08.173′N, −110°39,759′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 271-08*; Lewis River backwater on east side of main channel at confluence with Snake River, elev. 6871 ft, 44°08.537′N, −110°39.933′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 276-08*; Lewis Channel, north of Lewis Lake, downstream of fast water, elev. 7782 ft, 44°19.804′N, −110°38.749′W, *C. E. Hellquist and C. B. Hellquist 516-08*; Embayment at northeast end of Lewis Lake, elev. 7825 ft, 44°19.013′N, −110°36.460′W, 12 Aug 2008, *C. E. Hellquist and C. B. Hellquist 557-08*; East shore of Snake River, backwater in meadow along South Boundary trail, adjacent to hot spring channel (same as *265-08*), elev. 6887 ft, 44°08.068′N, −110°39.759′W, 28 July 2008, DNA, *C. E. Hellquist and C. B. Hellquist 852-10*; Yellowstone Lake at Bridge Bay bridge, floating along the shore, elev. 7768 ft, N°44°31.894′N, −110°26.178′9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 999-10*; Southeast shore of Lewis Lake, south of public launch site, elev. 7752 ft, 44°16.786′N, −110°37.903′W, 9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1009-10*; Marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.707′N, −110°12.93′W, 17 Aug 2010, DNA, *C. E. Hellquist, C. B. Hellquist, and H. Anderson 1130-10*; Old marina, Yellowstone Lake at Grant Village, elev. 7732 ft, ca. 44°23.607′N, −110°33.234′W, 18 Aug 2010, DNA, *C. E. Hellquist and M. T. Hellquist 1142-10*; Little Thumb Creek backwater at Yellowstone Lake, ca. 1.0 mile north of West Thumb Geyser Basin, elev. 7854 ft, 44°26.246′N, −110°34.770′W, 22 Aug 2010, DNA, *C. B. Hellquist and M. T. Hellquist 1148-10.* **Park Co.:** Eastern shore of Yellowstone River north of Fishing Bridge, elev. 7739 ft, 44°34.001′N, −110°22.652′W, 8 Aug 2010, *C. E. Hellquist, C. B. Hellquist and X. Vu 996-10*; Washed ashore on north end of Yellowstone Lake, east of Pelican Creek and east of Fishing Bridge, elev. 7736 ft, 44°33.161′N, −110°21.108′W, 11 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1037-10*; Yellowstone River between Buffalo Ford and Nez Perce Ford, north of Fishing Bridge, elev. 7708 ft, 44°37.093′N, −110°25.096′W, 12 Aug 2010, DNA, *C. E. Hellquist and C. B. Hellquist 1053-10*; Yellowstone River at "Grizzly Curve" Hayden Valley, Canyon-Lake Rd, elev. 7680 ft, 44°39.256′N, −110°27.809′W, 12 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1071-10.*

Najas flexilis (Willd.) Rostk. & W. L. E. Schmidt

Najas flexilis (water-nymph) is an annual with subopposite, long tapered, serrulate leaves that appear whorled. *Najas flexilis* was found in Winegar Lake along the southern boundary of YNP. This site is the first record for *Najas flexilis* in YNP and in Wyoming. The species is found predominantly in eastern North America with a more or less contiguous range from Newfoundland south to New Jersey, Ohio, and Missouri and west to Minnesota (Haynes 2000a). In western North America, the range of *N. flexilis* is interrupted with records from Saskatchewan, Alberta, British Columbia, Washington, Oregon, California, Idaho, Montana, and Utah (Haynes 2000).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Eastern end of Winegar Lake, south of South Boundary Trail, Bechler District. elev. 6452 ft, 44°08.234′N, −110°57.483′W, 6 Aug 2010, *C. E. Hellquist and C. B. Hellquist 976-10.*

ISOËTACEAE

Isoëtes echinospora Durieu

Only *Isoëtes occidentalis* L. F. Hend. and *I. bolanderi* Engelm. were previously known to occur in the GYE (Evert 2010) and Wyoming (Dorn 2001). *Isoëtes echinospora* (spiny-spored quillwort) is a new species of quillwort for Wyoming. We found *I. echinospora* in one locality along the south boundary of YNP. *Isoëtes echinospora* has spores with distinct spines that easily distinguish it from the two other species of *Isoëtes* in YNP. This circumboreal quillwort is a species of eastern and northern affinity in North America (Taylor et al. 1993). Its range extends from Newfoundland to Alaska, across the northeastern United States and Great Lakes region. In the west, *I. echinospora* is found in the northern prairie provinces, south into Idaho, western Montana, and along the Pacific coast to northern California. The YNP locality is a regionally isolated location between the panhandle of Idaho and additional isolated localities in northern Utah and central Colorado (Taylor et al. 1993).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Eastern end of Winegar Lake, south of South Boundary Trail, Bechler District, elevation 6452 ft, 44°08.234′N, −110°57.483′W, 6 Aug 2010, *C. E. and C. B. Hellquist 1154-10.*

Isoëtes occidentalis L. F. Hend.

Isoëtes occidentalis (western quillwort) was found in five sites in YNP. It is a species of western affinity found from southern British Columbia south to central California and east into Washington, Idaho, Montana, Colorado, Utah, and northwest Wyoming (Taylor et al. 1993) and is a species of concern in Wyoming (G4G5/S1). *Isoëtes occidentalis* was found in Yellowstone Lake and sites further south. Robust *I. occidentalis* with stout leaves were found washed up on the northern shoreline of Yellowstone Lake at the inlet of Pelican Creek. Evert (2010) states that *I. occidentalis* is known only from YNP in Wyoming and that it is found at elevations between 7500–7800 ft, although we did find it in the Lewis River at 6871 ft. *Isoëtes bolanderi* and *I. occidentalis* can be differentiated by leaf structure. *Isoëtes bolanderi* has leaves that taper to an acute tip while *I. occidentalis* has leaves that taper gradually to the tip (Taylor et al. 1993).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Washed ashore on north end of Yellowstone Lake, east of Pelican Creek and east of Fishing Bridge, elev. 7736 ft, 44°33.161′N, −110°21.108′W, 11 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1025-10.* **Teton Co.:** Lewis River backwater on east side of main channel at confluence with Snake River, elev. 6871 ft, 44°08.537′N, −110°39.822′W, 28 July 2008, *C. E. Hellquist and C. B. Hellquist 279-08*; Lewis River ca. 0.5 mile south of Lewis Falls along Grant–South Entrance Rd, elev. 7759 ft, 44°15.586′N, −110°38.382′W, 11 Aug 2008, *C. E. Hellquist and C. B. Hellquist 566-08*; East end of Winegar Lake, south of South Boundary Trail, Bechler District. elev. 6452 ft, 44°08.234′N, −110°57.483′W, 6 Aug 2010, *C. E. Hellquist and C. B. Hellquist 979-10*; Southeast shore of Lewis Lake, south of public launch site, elev. 7752 ft, 44°16.786′N, −110°37.903′W, 9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1008-10.*

LENTIBULARIACEAE

One result of our work in YNP has been the realization that the bladderworts of the region need substantial taxonomic attention. Based on our work and the critical assistance of B. Rice and G. Crow, the bladderworts in YNP consist of four species: *U. intermedia* Hayne, *U. minor* L., *U. ochroleuca* Hartm., and *Utricularia vulgaris* L. subsp. *macrorhiza* (LeConte) Clausen.

Although we collected fertile material whenever possible, vegetative stands of *Utricularia* were abundant. Differences between the four YNP *Utricularia* species can be judged based on floral characteristics related to the pedicel and the relative sizes of the corolla lip and spur (Thor 1988). The vegetative features of the species are also variable, and potential differences are subtle. We found that small vegetative *U. vulgaris* subsp. *macrorhiza* was easily confused with *U. minor*. *U. ochroleuca* also was easily misidentified as *U. minor*. Thor (1988) states that bristles on the teeth of leaf segments as well as the relative spur size compared to the lower lip of the corolla distinguishes *U. minor* from the other three YNP *Utricularia*. In the absence of flowers, the angles of quadrifid glands in traps are critical for species determination (Thor 1988). Due to the intergrading floral and vegetative characteristics of YNP *Utricularia*, the best characteristics to determine *U. ochroleuca*, *U. minor*, and *U. intermedia* are the arrangement of internal glands within the bladders (G. E. Crow, personal communication).

Utricularia intermedia Hayne

Utricularia intermedia (flatleaf bladderwort) is a species of concern in Wyoming (G5/S1), which is quite similar in appearance to *U. ochroleuca.* The earliest Wyoming collection of *U. intermedia* was in 1977, a specimen annotated by G. Crow during research for the treatment of the Lentibulariaceae for the Flora of North America, collected in the Gros Ventre Range (*Lichvar 1290* [RM]). *Utricularia intermedia* is known from the Elk National Refuge, near Jackson Hole, WY. *Utricularia intermedia* is the rarest bladderwork in YNP. It is known from a *Sphagnum*-sedge dominated peatland at the south end of Beula Lake along the southern border of YNP (*E. F. Evert 41455* [YELLO]). In 2010, we collected *U. ochroleuca* from Beula Lake as well as *U. intermedia* in what we presume is the same boggy area along the Beula Lake outlet stream where Evert collected. The overlap in habitat preferences of these species adds to the identification difficulties that cannot be readily discerned in the field (see *U. ochroleuca* below). Another specimen from the northwest corner of Beula Lake appears to be a mixed collection of *U. intermedia* and *U. ochroleuca* (*J. M. Lemly and D. J. Cooper 1412* [YELLO]).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Shallow shoreline of stream at southwestern corner of Beula Lake, elev. 7411 ft, 44°09.2429′N, −110°46.0304′W, 28 July 2010, *C. E. Hellquist and C. B. Hellquist 846-10*; Narrow stream (1 ft wide) at southwestern corner of Beula Lake at trails end, elev. 7411 ft, 44°09.2429′N, −110°46.0304′W, 28 July 2010, *C. E. Hellquist and C. B. Hellquist 847-10.*

Utricularia minor L.

Utricularia minor (lesser bladderwort) is listed as a Plant Species of Potential Concern (G5/S3). Previous records for *U. minor* are known from approximately 30 extant and two historic records in Wyoming (B. Heidel, personal communication). Previous collections of *U. minor* in YNP include YELLO records from thermal wetlands west of the Grand Loop Road in the Old Faithful area (*Anderson 131B*) and from a pond on the floating mat of Robinson Lake (*Anderson and Harpel 150B*). We found that in the field, small, sterile, more gracile individuals of *U. vulgaris* were easily confused with *U. minor*. We also learned that sterile specimens of what often appeared to be *U. minor* were in fact *U. ochroleuca* when quadrifid glands were examined (G. E. Crow personal communication; see *U. ochroleuca* below).

USA. IDAHO. YELLOWSTONE NATIONAL PARK. **Fremont Co.:** Robinson Lake, Bechler District, lake a peat mat surrounded by a band of water dominated by *Nuphar*. elev. 6560 ft, 44°09.930′N, −111 04.213′W, 5 Aug 2010, *C. E. Hellquist and C. B. Hellquist 941-10.* WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Warm stream on the east side of the Norris–Madison Jct. highway near culvert at the south end of Elk Park. elev. 7526 ft, 44°42.956′N, - 110°43.592′W, 23 July 2008, *C. E. Hellquist and C. B. Hellquist 204-08*; "Second Quadrant Pond" due west of Swan Lake and power line, pond covered by sedges and grasses, elev. 7620 ft, 44°55.303′N, −110°45.790′W, 20 July 2010, *C. E. Hellquist and C. B. Hellquist 762-10*; "Third Quadrant Pond", due west of Swan Lake and power line, pond covered by sedges and grasses, elev. 7674 ft, 44°46.096′N, −110°46.096′W, 20 July 2010, *C. E. Hellquist and C. B. Hellquist 766-10*; "Fourth Quadrant Pond" due west of Swan Lake and power line, only small area of standing water, elev. 7679 ft, 44°55.567′N, −110°46.127′W, 20 July 2010, *C. E. Hellquist and C. B. Hellquist 769-10.* **Teton Co.:** Embayment at northeastern end of Lewis Lake. Elev. 7825 ft, 44°19.013′N, 110°36.420′W, 11 Aug 2008. *C. E. Hellquist and C. B. Hellquist 604-08.*

Utricularia ochroleuca Hartm.

Utricularia ochroleuca (yellowish-white bladderwort) was documented from several new locations in this study, and is also known from several specimens annotated in 2013 by G. E. Crow. The collections from this study and recently annotated records add a new species to the flora of Wyoming and YNP. *Utricularia ochroleuca* is a circumboreal bladderwort with yellowish-white flowers. It is found in Canada from the Northwest Territories south to Manitoba and east to Nova Scotia (Taylor 1989). In the United States, this uncommon bladderwort has been reported from nine states including New York, Minnesota, Colorado, Alaska, Washington, Oregon, and California (NatureServe 2012). Taylor (1989) also includes Ohio in its range. The nearest record of *U. ochroleuca* to YNP is located in Colorado (Taylor 1989; USDA 2012). The YNP records fill a geographic gap in the distribution of *U. ochroleuca* in the western United States.

Utricularia ochroleuca primarily occurs in shallow waters associated with wetlands such as bogs and marshes (Taylor 1989). In YNP, we typically found *U. ochroleuca* in quiet, sheltered water such as small gaps in peaty turf extending into open water and gently flowing streams. These are also the habitats where we found all other *Utricularia* species as well. However, almost all of our collection sites for *U. ochroleuca* were found in the vicinity of or in water connected to hydrothermal features such as in the Gibbon and Lower Geyser Basins. Water chemistry analyses may help distinguish chemical preferences of *Utricularia* species in YNP (Hellquist et al., unpublished data).

Based on the inconspicuous appearance of *U. ochroleuca,* it can be mistaken for the more common *U. intermedia* (Taylor 1989). In our experiences, *U. ochroleuca* can be easily mistaken for *U. minor* if the quadrifid glands in the bladders are not microscopically examined (see below). It seems likely that *U. ochroleuca* may be more widespread, but easily overlooked within its range. For example, two YNP records of *U. ochroleuca* were found during research for the treatment of the Lentibulariaceae for the Flora of North America (G. Crow, personal communication). One specimen deposited at Rocky Mountain Herbarium (RM) was collected in 1991 northwest of Norris Jct. by E. F. Evert (*21763*), and originally identified as *U. minor.* A second RM specimen, collected in 1901 by M. E. Jones, was identified only as *Utricularia* with the location cited as "Yellowstone National Park" (G. Crow, personal communication). In addition, two 2012 collections by B. Heidel from the Upper Green River in Wyoming, also have been identified as *U. ochroleuca* by G. E. Crow. In 2013, G. E. Crow annotated additional YELLO specimens of *U. ochroleuca* that were either originally determined as *U. minor* or *Utricularia* sp. from the Gibbon River (*Lemly and Cooper 196*), Tangled Creek (*J. J. Whipple 3112*), Tuff Cliff fen (*J. J. Whipple 4326*), a geothermally influenced wetland adjacent to the Shoshone Geyser Basin (*J. J. Whipple 6345*), in creeks and thermal areas at Three River Junction (*Whipple and Anderson 6768, 6778, 6788*), and in a geothermally influenced wetland near Hot Lake (*Whipple, Fertig, and Welp 4950*).

Differentiating *U. intermedia, U. minor,* and *U. ochroleuca* can be problematic, especially in the field. Distinguishing characteristics of the species are provided by Taylor (1989) based on previous work by Glück (1906). Characteristics observed with magnification that we found helpful to tentatively identify *U. intermedia* were acute leaf segment tips, curved setiform appendages above the trap mouth, and the traps almost always completely segregated from green foliage. These characters contrast with *U. ochroleuca*, which has more obtuse leaf segment tips, long, straight setiform appendages above the trap mouth, and the sparsely scattered traps among green leaves. However, the most convincing characteristics require microscopic examination of the arrangement, length, and arm angle of the internal quadrifid glands of bladders (Thor 1988; Taylor 1989, G. Crow, personal communication). A thorough assessment of the abundance of *U. ochroleuca* in the Rocky Mountain region is needed.

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Small thermal seep east of main channel of the Gibbon River west of Norris Picnic Area, elev. 7699 ft, 44°43.659′N, −110°41.336′W, 5 Aug 2008, *C. E. Hellquist and C. B. Hellquist 91-08;* Small muddy pool east of Gibbon River at Gibbon Meadows north of Artists Paint Pots, Norris–Madison Jct. Rd, elev. 7376 ft, ca. 44°42.138′N, −110°44.841′W, 1 Aug 2008, *C. E. Hellquist and C. B. Hellquist 370-08;* North Twin Lake along Mammoth-Norris Rd, elev. 7574 ft, 44°46.571′N, −110°44.180′W, 7 Aug 2008, *C. E. Hellquist and C. B. Hellquist 465-08.* **Teton Co.:** Firehole River south of Old Faithful and Upper Geyser Basin, elev. 7433 ft, 44°27.388′N, −110°49.257′W, 30 July 2008, *C. E. Hellquist, C. B. Hellquist and J. Whipple 307-08;* Gibbon River upstream from Gibbon Falls north of Beryl Spring along Norris-Madison highway, elev. 7147 ft, 44°40.922′N, −110°44.657′W, 1 Aug 2008, *C. E. and C. B. Hellquist 390-08*; Embayment at northeast end of Lewis Lake, elev. 7825 ft, 44°19.013′N, −110°36.460′W, 11 Aug 2008, *C. E. Hellquist and C. B. Hellquist 560-08*; Thermally-warmed stream flowing out of Sentinel Meadows at intersection of Sentinel Meadows Trail, elev. 7242 ft, 44°33.804′N, −110°50.974′W, 19 July 2010, *C. E. Hellquist and C. B. Hellquist 741-10*; Thermal seep west of Flat Cone Spring, Sentinel Meadows, elev. 7240 ft, 44°33.857′N, −110°51.692′W, 19 July 2010, *C. E. Hellquist and C. B. Hellquist 742-10*; Pond immediately alongside Norris-Mammoth Rd, north of Norris and south of Nymph Lake, pond thermally influenced, elev. 7540 ft, 44°45.027′N, −110°43.000, 29 July 2010, *C. E. Hellquist and C. B. Hellquist 862-10*; North shore of Nymph Lake, Norris-Mammoth Rd, north of Norris, lake thermally influenced, elev. 7492 ft, 44°45.0175′N, −110°43.590′W. 29 July 2010, *C. E. Hellquist and C. B. Hellquist 868-10*; South shore of Lewis Lake at outlet, in thermal seep, elev. 7752 ft, 44°16.595′N, −110°38.164′W, 9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1003-10, 1014-10.*

PLANTAGINACEAE

Callitriche heterophylla Pursh

Callitriche heterophylla (water-starwort) was found at two sites within YNP. These two records were the first for YNP. Evert (2010) cites an additional record from Teton Co, WY. In Wyoming, *C. heterophylla* is widely distributed, but is the least common species of *Callitriche* (Dorn 2001).

Callitriche heterophylla could be mistaken for *C. verna* L. (syn. *C. palustris* L.). Dimensions of the fruit are diagnostic to distinguish the two species. In *C. heterophylla,* the fruit is as long as wide while in *C. verna* the fruit is longer than wide (Crow and Hellquist 2000).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Dried pond above

Crystal Creek, springs to the southeast, dried buffalo wallow, elev. 6839 ft, 44°53.946′N, −110°17.886′W, 14 July 2010, *C. E. Hellquist and C. B. Hellquist 680-10*; Yellowstone River between Buffalo Ford and Nez Perce Ford, north of Fishing Bridge, elev. 7708 ft, 44°37.093′N, −110°25.096′W, 12 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1051-10.*

POTAMOGETONACEAE

Potamogeton amplifolius Tuckerman

Although abundant in eastern and midwestern North America, *Potamogeton amplifolius* (big-leaved pondweed) populations are scattered in western North America (Haynes and Hellquist 2000). *Potamogeton amplifolius* is a striking species with large, long-petiolate (up to 23 cm) floating leaves and broad, arcuate submersed leaves (up to 13 cm long) that have stout, persistent stipules (up to 12 cm; Haynes and Hellquist 2000).

We found four YNP locations for *P. amplifolius* in deep water of lakes. Evert (2010, p. 546) states that the species is rare in the GYE and is found in "a few" YNP lakes in addition to Fremont County and Park County, WY. Evert (2010) does not note where in YNP *P. amplifolius* is found, and no records from YNP prior to our inventory are deposited in YELLO or RM. In Wyoming, *P. amplifolius* is a Wyoming species of concern (G5/S1) with three extant and two historic locations.

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Goose Lake along east side of Fairy Falls Trail between Fountain Flats and Midway Geyser Basin, elev. 7224 ft, 44°32.540′N, −110°50.624′W, 4 Aug 2008, *C. E. Hellquist and C. B. Hellquist 400-08*; Lewis River north of Lewis Lake, downstream of fast water, elev. 7782 ft, 44°19.804′N, −110°38.749′W, 9 Aug 2008, *C. E. Hellquist and C. B. Hellquist 509-08*; Lewis Lake in ca. 6 ft. of water along northeast shore, 44°18.511′N, −110°37.179′W. 9 Aug 2008, *C. E. Hellquist and C. B. Hellquist 603-08*; Shore of Shoshone Lake near DeLacy Creek, fragment along shore, elev. 7791 ft, 44°24.5878′N, −110°41.7895′W, 24 July 2010, *C. E. Hellquist and C. B. Hellquist 780-10*; Floating on southeast shore of Lewis Lake, south of public launch site, elev. 7752 ft, 44°16.786′N, −110°37.903′W, 9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1010-10.*

Potamogeton foliosus subsp. *fibrillosus* (Fernald) R. R. Haynes and Hellq.

Potamogeton foliosus subsp. *fibrillosus* (fibrous pondweed) has been long reported from YNP (Haynes and Reveal 1973) and was a taxon of significant interest for our survey. The range of *Potamogeton foliosus* subsp. *fibrillosus* includes California, Washington, Idaho, and Utah (Hellquist et al. 2012). *Potamogeton foliosus* subsp. *fibrillosus* is often reported from waters influenced by geothermal activity, but it is not exclusively found in geothermal hydrology (Haynes and Reveal 1973).

This perplexing western North American taxon has been recognized at a variety of levels. Initially recognized as *P. fibrillosus* Fern. (Fernald 1932), its classification was later revised to *P. foliosus* var. *fibrillosus* (Fern.) Haynes and Reveal (Haynes and Reveal 1973). More recently, it has been classified as *P. foliosus* subsp. *fibrillosus* (Haynes and Hellquist 2002; Hellquist et al. 2012).

Despite a focused effort to find *P. foliosus* subsp. *fibrillosus* in YNP, we were unable to find any conclusive populations of this taxon. In YNP, we collected what we believed to be *P. foliosus* subsp. *fibrillosus* at several sites, all influenced by hydrothermal conditions (sites in Fountain Flats, as well as along the Firehole River and Nez Perce Creek). To confirm our initial determinations, we sent five YNP collections we believed were *P. foliosus* subsp. *fibrillosus* to Z. Kaplan and J. Fehrer for genetic analysis (Hellquist et al., unpublished data). DNA fingerprinting of our morphologically variable specimens that we suspected were *P. foliosus* subsp. *fibrillosus* revealed some of our collections were *P. pusillus*, *P. foliosus,* or a hybrid between *P. pusillus* and *P. foliosus* (Z. Kaplan, personal communication). Our inability to locate this taxon, in addition to the mixture of collections we thought were *P. foliosus* subsp. *fibrillosus* prior to genetic analysis was surprising. We believe that the morphological diversity within *P. foliosus* subsp. *fibrillosus* (e.g., Haynes and Reveal 1973) may be the result of specimens of this taxon being of hybrid origin. Our fieldwork in YNP and our experiences with hybrid *Potamogeton* make us increasingly skeptical of the taxonomic validity of *P. foliosus* subsp. *fibrillosus.*

Potamogeton friesii Rupr.

Potamogeton friesii (Fries' pondweed) is a species restricted to highly alkaline waters throughout its range (Hellquist 1980). *Potamogeton friesii* is one of the narrow-leaved pusilloid species that can be difficult to identify. It is often confused with the more common *P. pusillus* L. or the equally uncommon *P. strictifolius*. *Potamogeton strictifolius* has a bold vein-like margin on its leaves that is absent *P. friesii.* The leaf tips of *P. friesii* are mucronate, while *P. strictifolius* usually has an acute leaf-tip. Both species have fibrous stipules that are obvious when plants are dried. *Potamogeton friesii* is most easily distinguished by its distinct turions that consist of leaves organized in a firm, fan-shaped arrangement with the inner leaves at right angles to the outer leaves.

In YNP, *P. friesii* was most often found in small, alkaline ponds in the northern range. This species is uncommon in YNP and Wyoming (G4/S1). In Wyoming, *P. friesii* is presently known from four extant and three historic sites (B. Heidel, personal communication) as well as two sites within YNP (Swan Lake, [*s.n. USFWS*, YELLO 5653]; eastern portion of Tern Lake, [*s.n. USFWS*, YELLO 5654]). In 2008 and 2010, eleven unrecorded YNP populations were located, six in the Gardiner Basin vicinity of Montana.

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Slide Lake, Gardiner Basin along Old Gardiner Rd, elev. 5723 ft, 45°00.301′N, −110°42.001′W, 9 July 2008, *C. E. Hellquist and C. B. Hellquist 10-08*; Landslide Lake ("Ice Lake") at Gardiner Basin, first lake upstream along Landslide Creek ca. 1.0 mile from Stevens Creek Rd, elev. 5487 ft, 45°01.993′N, −110°45.023′W. 9 July 2008, *C. E. Hellquist and C. B. Hellquist 13-08*; Lower Rainbow Lake at Gardiner Basin, south of Old Gardiner Rd, elev. 5876 ft, 45°01.444′N, −110°44.621′W, 29 Aug 2008, *C. E. Hellquist and C. B. Hellquist 290-08*; Fourth pond off Beaver Pond Trail Loop to the southwest, starting at the west end from Mammoth Hot Springs, elev. 6519 ft, 44°59.802′N, −110°43.418′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 819-10*; Sixth pond, the largest along Beaver Pond Trail Loop at the northeast corner of the loop, starting at the west end from Mammoth Hot Springs, elev. 6518 ft, 44°59.950′N, −110°43.117′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 824-10*; Small pond adjacent and below old beaver dam at sixth pond, the largest along Beaver Pond Trail Loop at the northeast corner of the loop, starting at the west end from Mammoth Hot Springs. elev. 6518 ft, 44°59.950′N, −110°43.117′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 825-10*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Buck Lake northeast of Trout Lake, Lamar Valley, elev. 6948 ft, 44°54.269′N, −110°07.600′W, 10 July 2008, *C. E. Hellquist and C. B. Hellquist 28-08*; Swan Lake, Swan Lake Flat along west side of highway, elev. 7288 ft, 44°55.168′N, −110°44.124′W, 15 July 2008, *C. E. Hellquist, C. B. Hellquist, and S. Gunther* 86-08, 23 July 2008, *C. E. Hellquist and C. B. Hellquist 173-08*. Blacktail Pond east of Mammoth, Blacktail Deer Plateau, Mammoth-Tower highway, elev. 6643 ft, 44°57.264′N, −110°36.215′W, 25 July 2008, *C. E. Hellquist and C. B. Hellquist 221-08*; Floating Island Lake on south side of Mammoth-Tower highway, elev. 6600 ft, 44°56.493′N, −110°27.064′W, 25 July 2008, *C. E. Hellquist and C. B. Hellquist 230-08*; "Foster Lake" west of Soda Butte, north of Lamar River trailhead along the Tower-Northeast Rd, elev. 6723 ft, 44°52.344′N, −110°10.076′W, 14 Aug 2008, *C. E. Hellquist and C. B. Hellquist 580-08*. **Teton Co.:** marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, at mouth of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist and H. Anderson, 1117-10*.

Potamogeton obtusifolius Mert. & W. D. J. Koch

Potamogeton obtusifolius (bluntleaf pondweed) is a new species for the YNP flora and was listed as a historical species for Wyoming prior to our work (Heidel 2012). We found *P. obtusifolius* at single location (Cascade Lake) near Canyon Junction. This species is noted for having especially wide leaves (5–7 mm) for a linear-leaved pondweed (Haynes and Hellquist 2000). The leaves often appear two-ranked, are flaccid, and have distinct, broadly rounded leaf tips (Haynes and Hellquist 2000). The species can reproduce prolifically from winter buds. *Potamogeton obtusifolius* is found primarily in northeastern North America and in the northern Great Lakes region. Isolated occurrences are found in western North America in far northern Canada, the Prairie Provinces, Alaska, British Columbia, Washington, Montana, and Wyoming (Haynes and Hellquist 2000).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Cascade Lake, northeast of Canyon Jct., elev. 8059 ft, 44°44.996′N, −110°31.514′W, 2 Aug 2010, *C. E. Hellquist and C. B. Hellquist 895-10*.

Potamogeton praelongus Wulfen

Potamogeton praelongus (white-stem pondweed) is similar to the common *P. richardsonii* (Ar. Benn.) Rydb., but has a distinct white zigzag stem and leaves that are less perfoliate than *P. richardsonii*. *Potamogeton praelongus* typically has keeled leaf tips that split when pressed (Crow and Hellquist 2000). This species, like *P. amplifolius*, is characteristic of deep waters of lakes and is one of the earliest species to flower and fruit during the growing season. *Potamogeton praelongus* is a species of concern in Wyoming (G5/S1S2) and is known from eleven Wyoming sites, four within YNP (B. Heidel, personal communication). One site is from a pond near the Mammoth Hot Springs hotel that no longer exists. Other known YNP sites include a pond near Mt. Everts (*Gresswell s.n.* [YELLO]) and Heart Lake (*J. J. Whipple 6550* [YELLO]). Our

YNP collections include two sites from Montana and six from Wyoming.

Some of our collections of *P. praelongus* were somewhat puzzling morphologically. Although morphologically consistent in most characters, our YNP collections did not always show the usually reliable trait of keeled leaf tips in our collections. We suspect that some of our collections may be hybrids. The genetic composition of these YNP collections is currently being investigated (Hellquist et al., unpublished data).

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Slide Lake, Gardiner Basin along Old Gardiner Rd, elev. 5723 ft, 45°00.301′N, −110°42.001′W, 9 July 2008, *C. E. Hellquist and C. B. Hellquist 6-08*; Upper Rainbow Lake at Gardiner Basin, south of Old Gardiner Rd, elev. 5883 ft, 45°01.338′N, −110°44.463′W, 29 July 2008, *C. E. Hellquist and C. B. Hellquist 296-08*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Fragment floating on shore of Grebe Lake north of Norris-Canyon Rd, elev. 8023 ft, 44°45.0373′N, −110°33.2234′W, 30 July 2010, *C. E. Hellquist and C. B. Hellquist 870-10*; Floating along shore of Cascade Lake, northeast of Canyon Jct., elev. 8059 ft, 44°44.996′N, −110°31.514′W, 2 Aug 2010, *C. E. Hellquist and C. B. Hellquist 907-10*. **Teton Co.:** North end of Riddle Lake, elev. 7913 ft, 44°26.713′N, −110°33.026′W, 27 July 2008, *C. E. Hellquist and C. B. Hellquist 245-08*; Bridge Bay, Yellowstone Lake, floating on surface, elev. 7769 ft, 44°31.884′N, −110°26.178′W, 10 Aug 2008, *C. E. Hellquist and C. B. Hellquist 530-08*; West shore of Beula Lake at trails end, fragment floating along shore, elev. 7411 ft, 44°09.2429′N, −110°46.0304′W, 28 July 2010, *C. E. Hellquist and C. B. Hellquist 835-10*; Deep water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist and H. Anderson 1118-10*.

Potamogeton robbinsii Oakes

Potamogeton robbinsii (Robbins' pondweed) is a rare plant in YNP and Wyoming (G5/S1). Prior to 2008, only three records were documented for *P. robbinsii* in YNP. Previously *P. robbinsii* was collected from Winegar Lake (*R. Gresswell s.n.* [YELLO]), Heart Lake (*C. Richardson s.n.* [GH, RM]), and from the shore of Heart Lake (*H. Anderson et al.* 038 [YELLO 12070]). In 2010, we found new locations in Grebe Lake, Winegar Lake, and several sites around Yellowstone Lake.

Potamogeton robbinsii, like *P. obtusifolius*, has the most contiguous part of its range in the northeast into the Great Lakes region with disjunct populations in the far north, the Rocky Mountains, and in the Pacific states and provinces (Haynes and Hellquist 2000). *Potamogeton robbinsii* is easily recognizable with its stiff, two-ranked, sessile leaves that are serrulate with auriculate bases. *Potamogeton robbinsii* rarely blooms. It is unusual as the only pondweed with branched inflorescences (Haynes and Hellquist 2000). Although the species does not have true turions, *P. robbinsii* easily breaks apart into fragments that produce prolific adventitious roots. These fragments can be found washing on shore, lying flat on submerged sediments, and can contribute to the formation of dense stands in deep water.

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Grebe Lake north of Norris-Canyon Rd, elev. 8023 ft, 44°45.0373′N, −110°33.2234′W, 30 July 2010, *C. E. Hellquist and C. B. Hellquist 869-10*. **Teton Co.:** Eastern end of Winegar Lake, south of South Boundary Trail, Bechler District, elev. 6452 ft, 44°08.234′N, −110°57.483′W, 6 Aug 2010, *C. E. Hellquist and C. B. Hellquist 975-10*; Yellowstone Lake at Bridge Bay bridge, floating along shore, elev. 7768 ft, 44°31.894′N, −110°26.178′W, 9 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1000-10*; Floating in marshy open water at the southwest corner of the Southeast Arm of Yellowstone Lake, north of Trail Creek, elev. 7732 ft, ca. 44°17.7074′N, −110°12.9316′W, 17 Aug 2010, *C. E. Hellquist, C. B. Hellquist, and H. Anderson 1129-10*; Washed ashore on north end of Yellowstone Lake, east of Pelican Creek and east of Fishing Bridge, elev. 7736 ft, 44°33.161′N, −110°21.108′W, 11 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1035-10, 1036-10*; Old marina, Yellowstone Lake at Grant Village, elev. 7732 ft, ca. 44°23.607′N, −110°33.234′W, 20 Aug 2010, *C. E. Hellquist and M. T. Hellquist 1139-10*.

Potamogeton strictifolius A. Benn.

We found *Potamogeton strictifolius* (narrowleaf pondweed) in four small alkaline ponds in the far northern portions of YNP within Montana. Like *P. friesii*, *P. strictifolius* is usually found with species associated with alkaline water (Hellquist 1980). There appear to be no verified records of this species from Montana, even though it is thought to occur in the state (S. Mincemoyer, personal communication). *Potamogeton strictifolius* is a species of concern in Wyoming (G5/S1?). It is known from several sites in the state (B. Heidel, personal communication) including a specimen from the Firehole River (Porter 6385; RM). Two collections in YELLO (*Gresswell 4601, 4740*) from a pond on Mt. Everts and Big Trumpeter Lake are also *P. strictifolius*. Previously, *P. strictifolius* was found in the Yellowstone River (*J. J. Whipple and M. Hektner 6593* [YELLO]) and Madison Rivers. We could not relocate *P. strictifolius* at the

Yellowstone River location. *Potamogeton strictifolius* was cited from the upper reaches of the Madison River (Wright and Mills 1967), but we have not located any populations in that area or seen any herbarium records from the Madison River vicinity. Some collections that we initially believed were *P. strictifolius* in the field were in fact *P. pusillus* as shown by genetic analysis (Z. Kaplan, personal communication). Based on the abundance of *P. pusillus* in YNP rivers, and our own YNP collections that showed that *P. pusillus* can take on a *P. strictifolius*-like aspect in YNP rivers, we believe that Wright and Mills (1967) were probably observing *P. pusillus* in the Madison River. Collections of pusilloid *Potamogeton* species from rivers that appear at first glance to be *P. strictifolius* in the GYE should be identified with caution.

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Slide Lake, Gardiner Basin along Old Gardiner Rd, elev. 5723 ft, 45°00.301′N, −110°42.001′W, 9 July 2008, *C. E. Hellquist and C. B. Hellquist 287-08*; Landslide Creek Lake ("Ice Lake") in Gardiner Basin, first lake upstream along Landslide Creek ca. 1.0 mile from Old Gardiner Rd, elev. 5487 ft, 45°01.993′N, −110°45.023′W, 9 July 2008, *C. E. Hellquist and C. B. Hellquist 13a-08*; Lower Rainbow Lake at Gardiner Basin, south of Old Gardiner Rd, elev. 5876 ft, 45°01.444′N, −110°44.621′W, 29 July 2008, *C. E. Hellquist and C. B. Hellquist 291-08*; Upper Rainbow Lake at Gardiner Basin south of Old Gardiner Rd, elev. 5883 ft, 45°01.338′N, −110°44.463′W, 29 July 2008, *C. E. Hellquist and C. B. Hellquist 299-08*.

Potamogeton zosteriformis Fernald

Potamogeton zosteriformis (flat-stemmed pondweed) is a linear-leaved species that has three distinct veins, but upon closer observation with magnification many smaller veins are visible. The numerous fine veins (15–35) are most conspicuous when specimens are dried. The stem is broadly flattened or winged and may be as wide as the leaves (Haynes and Hellquist 2000). *Potamogeton zosteriformis* is often found growing from large winter buds as was observed at Sylvan Lake and in Bridge Bay (Yellowstone Lake).

Potamogeton zosteriformis is uncommon in the northwest portion of its range and is a species of concern in Wyoming (G5/S1). *Potamogeton zosteriformis* was known historically from a single site in Grand Teton National Park (*Solheim 4067* [RM]). Our survey includes four new Wyoming YNP populations located in lakes or slow moving water.

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Sylvan Lake west of Sylvan Pass along East Entrance Rd, elev. 8461 ft, 44°28.677′N, −110°09.477′W, 24 July 2008, *C. E. Hellquist and C. B. Hellquist 209-08*; 8 Aug 2008 *C. E. Hellquist and C. B. Hellquist 507-08*. **Teton Co.:** Lewis River north of Lewis Lake, downstream of fast water, elev. 7782 ft, 44°19.804′N, −110°38.749′W, 9 Aug 2008, *C. E. Hellquist and C. B. Hellquist 510-08*; Bridge Bay, Yellowstone Lake, elev. 7768 ft, 44°31.894′N, −110°26.178′W, 10 Aug 2008, *C. E. Hellquist and C. B. Hellquist 531-08*; Lewis Lake, floating along shore at north end of lake, elev. 7825 ft, 44°19.013′N, −110°36.460′W, 12 Aug 2008, *C. E. Hellquist and C. B. Hellquist 604-08*.

Stuckenia vaginata (Turcz.) Holub

The genus *Stuckenia* is well represented in YNP. Both *S. filiformis* and *S. pectinata* (L.) Börner are widespread. *Stuckenia vaginata* (sheathed pondweed) is identified by its large size and its coarse, multiple-branched morphology. It is distinct from the closely related *S. pectinata* by its green fruit, large inflated stipules, and blunt-tipped leaves versus flesh-colored fruit, tight stipules and acute-tipped leaves of *S. pectinata*. *Stuckenia vaginata* is the largest member of the genus in North America and is most abundant in the western United States and Canada. In Wyoming, it is not tracked because of its abundance in the southern counties of the state (B. Heidel, personal communication). In Montana, it is known from ten western counties (Lesica 2012). An additional population of *S. vaginata* was located just north of YNP in Dailey Lake in Park County, MT (*C. E. Hellquist 1176*).

Evert (2010) states that there is a single collection of *S. vaginata* from YNP collected in Geode Lake (*Gresswell s.n.* [YELLO]). However, this specimen is a misidentified collection of *Ruppia cirrhosa* (see below). In 2010, we surveyed Geode Lake and did not find *S. vaginata,* but found abundant *S. pectinata* and *R. cirrhosa.* During herbarium research for this project, we found a previously misidentified specimen of *S. vaginata* in YELLO collections from Foster Lake in the Lamar Valley and in 2008 located a large population of *S. vaginata* there. A second YNP site for *S. vaginata* was found at Slide Lake, located in the northwestern corner of YNP. At Slide Lake, *S. vaginata* was found with other species indicative of alkaline water including *Potamogeton friesii* and *P. strictifolius*. Two large populations also were found in separate basins in the Beaver Ponds to the northwest of Mammoth Hot Springs.

USA. MONTANA. YELLOWSTONE NATIONAL PARK. **Park Co.:** Slide Lake, Gardiner Basin along Old Gardiner Rd, elev. 5723 ft, 45°00.301′N, −110°42,001′W, 9 July 2008, DNA, *C. E. Hellquist and C. B. Hellquist 7-08*; 29 July 2008, DNA, *C. E. Hellquist and C. B. Hellquist*

288-08; Fourth pond off Beaver Pond Trail Loop to the southwest, starting at the west end from Mammoth Hot Springs, elev. 6519 ft, 44°59.802′N, −110°43.418′W, 26 July 2010, *C. E. Hellquist and C. B. Hellquist 817-10*; Sixth pond, the largest along Beaver Pond Trail Loop at the northeast corner of the loop, starting at the west end from Mammoth Hot Springs, elev. 6518 ft, 44°59.950′N, −110°43.117′W, 26 July 2010, C. *E. Hellquist and C. B. Hellquist 823-10.*

WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** "Foster Lake" west of Soda Butte, north of Lamar River trailhead along Tower–Northeast Rd, elev. 6723 ft, 44°52.344′N, −110°10.076′W, 14 Aug 2008, *C. E. Hellquist and C. B. Hellquist 579-08*. **Teton Co.:** "Little Lower Basin Lake", Lower Geyser Basin, west of Firehole Lake Drive, Madison-Old Faithful Rd, elev. 7243 ft, 44°32.231′N, −110°49.872′10W, 17 July 2010, *C. E. Hellquist and C. B. Hellquist 730-10*; Washed ashore on north end of Yellowstone Lake, east of Pelican Creek and east of Fishing Bridge, elev. 7736 ft, 44°33.161′N, −110°21.108′W, 11 Aug 2010, *C. E. Hellquist and C. B. Hellquist 1038-10.*

RUPPIACEAE

Ruppia cirrhosa (Petagna) Grande

Sometimes mistaken at a distance for a *Potamogeton*, *Ruppia* (widgeon-grass) can be distinguished by its growth along sediments where rooting occurs at nodes. The inflorescences are initially sheathed by leaves and later extended on distinctly coiled peduncles. *Ruppia cirrhosa* is found widely scattered from the Midwest of the United States to the Pacific Coast from Alaska to California (Haynes 2000b). Described as "seldom seen or collected" in the GYE (Evert 2010, p. 608), *R. cirrhosa* was found primarily in sites concentrated in the Upper and Lower Geyser Basins. *Ruppia* was found in water associated with hydrothermal features where it was the only or one of only a few aquatic vascular plants present. In the Upper Geyser Basin, *Ruppia* has been seen in bloom in November (J. J. Whipple, personal observation). Tweedy (1886, p. 66) describes *Ruppia* as "common" in geothermal areas of YNP and sometimes found in 32°C water. *Ruppia cirrhosa* is found in waters with high concentrations of calcium (Crow and Hellquist 2000; Haynes 2000b) and sulfur (Haynes 2000b), conditions that are consistent with our findings (Hellquist, unpublished data).

USA. WYOMING. YELLOWSTONE NATIONAL PARK. **Teton Co.:** Geode Lake north of the Mammoth-Tower Rd, near Black Canyon of the Yellowstone River, elev. 6003 ft, 44°58.604′N, −110°29.321′W, 22 July 2010, *C. E. Hellquist and C. B. Hellquist 776-10*; Pond between Geode Lake and Black Canyon of the Yellowstone, pond has abundant purple Sulfur bacteria, Mammoth-Tower Rd. elev. 5831 ft, 44°58.736′N, −110°28.964′W, 22 July 2010, *C. E. Hellquist and C. B. Hellquist 777-10*; West Sentinel wetland west of West Sentinel between Daisy Geyser and Grand Loop Rd, Upper Geyser Basin, elev. 7352 ft, 44°28.508′N, −110°50.813′W, 30 July 2008, *C. E. Hellquist, C. B. Hellquist and J. J. Whipple 329-08*; Small pond to the east of the Fairy Falls Trail south of Ojo Caliente Springs and Firehole River, elev. 7194 ft, 44°33.778′N, −110°50.231′W, 4 Aug 2008, *C. E. Hellquist and C. B. Hellquist 394-08*; Lewis Lake, floating along shore at north end of lake, elev. 7825 ft, 44°19.013′N, −115°36.460′W, 12 Aug 2008, *C. E. Hellquist and C. B. Hellquist 551-08*; Fountain Flats, pool near cone west of bike trail south of Ojo Caliente Spring, elev. 7164 ft, 44°33.478′N, −110°50.509′W, 10 July 2010, *C. E. Hellquist and C. B. Hellquist 640-10*; Fountain Flats, meandering tributary stream of Fairy Creek, stream has minor thermal influence, 44°33.465′N, −110°50.786′W, 10 July 2010, *C. E. Hellquist and C. B. Hellquist 649-10*; Fountain Flats, Lower Geyser Basin, Feather Lake east of Goose Lake, bottom of sandy gravel, elev. 7293 ft, 44°32.675′N, −110°50.270′W, 11 July 2010, *C. E. Hellquist and C. B. Hellquist 651-10*; Lower Geyser Basin, River Group thermal area wetlands, small shallow wetland pools, gaseous bubbling present, ca. four pools with *S. pectinata,* old spring with travertine, coffee-colored water partially surrounded by *Eleocharis* and *Schoenoplectus*, elev. 7227 ft, 44°33.859′N, −110°49.988′W, 12 July 2010, *C. E. Hellquist and C. B. Hellquist 660-10*; Fountain Flats on east side of bike trail west of Firehole River "pond 3", elev. 7161 ft, 44°33.3785′N, −110°50.293′W, 12 July 2010, *C. E. Hellquist and C. B. Hellquist 667-10*; Lower Basin Lake, Lower Geyser Basin, west of Firehole Lake Drive, Madison-Old Faithful Rd, elev. 7283 ft, 44°32.140′N, −110°49.390′W, 17 July 2010, *C. E. Hellquist and C. B. Hellquist 426-10*; Warm seep along former White Creek, west of Firehole Lake Drive, Madison-Old Faithful Rd., elev. 7312 ft, 44°32.166′N, −110°49.194′W, 17 July 2010, *C. E. Hellquist and C. B. Hellquist 732-10.*

TYPHACEAE (INCLUDING SPARGANIACEAE)

Sparganium natans L.

Sparganium natans (small bur-reed) is the smallest of the floating-leaved species of bur-reed known from the GYE. *Sparganium natans* was often found in shallow, geothermally influenced waters or in isolated, often stagnant pools in drying wetlands. In YNP, the foliage often has a distinct bright yellow green coloration. It is especially abundant in the Obsidian Creek drainage between Norris and Mammoth. In Wyoming, *Sparganium natans* was recently considered a species of concern, but has been collected often in YNP over the years. *Sparganium natans* was reported from YNP in collections by Rydberg and Bessey (1897) from Shoshone Lake and collections by F. Tweedy (1884) in the Gibbon River (Rydberg 1900). *Sparganium natans* was recently reported from sites including Nymph Lake, Obsidian Creek, North Twin Lake, and South Twin Lake (J. J. Whipple, unpublished data) and was found at these sites as well as others listed below.

USA. IDAHO. YELLOWSTONE NATIONAL PARK. **Fremont Co.:** "Pond" southeast of Bechler Ranger Station, only open water at east end, remainder covered by *Schoenoplectus acutus*, elev. 6355 ft, 44°08.510′N, −111°03.343′W, 4 Aug 2010, *C. E. Hellquist and C. B. Hellquist 922-10*; Robinson Lake, Bechler District, lake a peat mat surrounded by a band of water dominated by *Nuphar*, elev. 6569 ft, 44°09.930′N, −111°04.213′W, 5 Aug 2010, *C. E. Hellquist and C. B. Hellquist 944-10*. WYOMING. YELLOWSTONE NATIONAL PARK. **Park Co.:** Channeled wetlands and Obsidian Creek by Beaver Lake in waters warmed by geothermal activity, elev. 7402 ft, 44°49.083′N, −110°43.870′W, 18 July 2008, *C. E. Hellquist and C. B. Hellquist 133-08*; Obsidian Creek just west of the crossing of the Mammoth–Norris Rd at Obsidian Cliff, elev. 7460 ft, 44°49.418′N, −110°43.748′W, 18 July 2008, *C. E. Hellquist and C. B. Hellquist 141-08*; Obsidian Creek between entrance to Indian Creek Campground and Mammoth–Norris Rd. elev. 7444 ft, 44°52.947′N, −110°44.072′W, 18 July 2008, *C. E. Hellquist and C. B. Hellquist 147-08*; North Twin Lake along Mammoth–Norris Rd, elev. 7574 ft, 44°46.511′N, −110°44.180′W, 7 Aug 2008, *C. E. Hellquist and C. B. Hellquist 462-08*; South Twin Lake along Madison – Norris Rd, elev. 7571 ft, 44°46.275′N, −110°44.005′W, 7 Aug 2008, *C. E. Hellquist and C. B. Hellquist 469-08*; Stream flowing into Nymph Lake, north of Norris along the Norris-Mammoth Rd, stream thermally influenced, elev. 7492 ft, 44°45.201′N, −110°43.613′W, 29 July 2010, *C. E. Hellquist and C. B. Hellquist 858-10*; "Third Quadrant Pond", due west of Swan Lake and power line, pond covered by sedges and grasses, elev. 7674 ft, 44°55.441′N, −110°46.096′W, 20 July 2010, *C. E. Hellquist and C. B. Hellquist 764-10*; Pond immediately alongside Norris-Mammoth Hwy., north of Norris and south of Nymph Lake, pond thermally influenced, elev. 7540 ft, 44°45.027′N, −110°43.000′W, 29 July 2010, *C. E. Hellquist and C. B. Hellquist 860-10*; Small *Nuphar* pond on north side of Norris-Canyon Hwy., elev. 8103 ft, 44°43.077′N, −110°32.390′W, 2 Aug 2010, *C. E. Hellquist and C. B. Hellquist 911-10*. **Teton Co.:** Partially dried oxbow of the Gibbon River at Madison Jct., elev. 6793 ft, 44°38.534′N, −110°51.469′W, 1 Aug 2008, *C. E. Hellquist and C. B. Hellquist 386-08*; Harlequin Lake north of West Yellowstone–Madison Jct Rd, elev. 6896 ft, 44°38.598′N, −110°53.575′W, *C. E. Hellquist and C. B. Hellquist 419-08*; Southwestern-most pond north of trail to Nez Perce Patrol Cabin, north of Nez Perce Creek, Madison-Old Faithful Rd., pond mostly filled with grasses and sedges. elev. 7220 ft, 44°34.632′N, −110°48.828′W, 17 July 2010, *C. E. Hellquist and C. B. Hellquist 708-10*; South, small pond at jct of Bechler Meadows Trail and Boundary Creek Trail, elev. 6475 ft, 44°10.033′N, −111°01.958′W, 5 Aug 2010, *C. E. Hellquist and C. B. Hellquist 953-10*; South end of large pond at jct of Bechler Meadows Trail and Boundary Creek Trail, Bechler District, elev. 6475 ft, 44°10.033′N, −111°01.958′W, 5 Aug 2010, *C. E Hellquist and C. B. Hellquist 966-10*.

CONCLUSIONS

The complex geology and corresponding hydrology of YNP provides diverse aquatic habitat for uncommon and unusual aquatic vascular plants of the Rocky Mountain region. With additional reconnaissance into the interior of YNP, we anticipate more records for these species will be found. Forthcoming papers will provide a complete species inventory of the aquatic flora of YNP based on continuing fieldwork and will examine patterns of aquatic plant distribution in YNP as related to water chemistry. Our work also illustrates that field determinations of select aquatic taxa can sometimes be problematic due to morphological subtlety or potential hybridization. In an upcoming paper, we will describe the abundance and distribution of several hybrid *Potamogeton* and *Stuckenia* taxa found in YNP that we have confirmed with genetic analysis. The prevalence of hybrid taxa within *Potamogeton* and *Stuckenia* as well as the morphological similarities found within some *Potamogeton* and *Utricularia* highlights the need for further taxonomic studies of aquatic plants. Our results provide a basis for re-evaluating rarity among aquatic vascular plants of Yellowstone National Park, the GYE, and the northern Rocky Mountain region as a whole.

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LITERATURE CITED

AIKEN, S. G. 1981. A conspectus of *Myriophyllum* (Haloragaceae) in North America. Brittonia 33:57–69.

AL-SHEHBAZ, I. A. 2010. Brassicaceae Burnett. Pp. 224–747 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México, Vol. 7: Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, New York, NY.

CESKA, O., A. CESKA, AND P. D. WARRINGTON. 1986. *Myriophyllum quitense* and *Myriophyllum ussuriense* (Haloragaceae) in British Columbia, Canada. Brittonia 38:73–81.

COUCH, R. AND E. NELSON. 1988. *Myriophyllum quitense* (Haloragaceae) in the United States. Brittonia 40:85–88.

CROW, G. E. AND C. B. HELLQUIST. 2000. Aquatic and wetland plants of northeastern North America, Volume 1. Pteridophytes, gymnosperms, and angiosperms: dicotyledons. University of Wisconsin Press, Madison, WI.

DORN, R. D. 1984. Vascular plants of Montana. Mountain West Publishing, Cheyenne, WY.

———. 2001. Vascular plants of Wyoming. 3rd ed. Mountain West Publishing, Cheyenne, WY.

EVERT, E. F. 2010. Vascular plants of the Greater Yellowstone Area: Annotated catalog and atlas. Published by Erwin F. Evert, Park Ridge, IL.

FASSETT, N. C. 1957. A manual of aquatic plants. With revision appendix by E. C. Ogden. University of Wisconsin Press, Madison, WI.

FERNALD, M. L. 1932. The linear-leaved North American species of *Potamogeton* section *Axillares*. Memoirs of the American Academy of Arts and Sciences 17:1–183.

GLÜCK, H. 1906. Biologische und morphologische Untersuchungen über Wasser- und Sumpfgewächse. Vol. 2, Untersuchungen über die mitteleuropäischen *Utricularia*-Arten, über die Turionenbildung bei Wasserpflanzen, sowie über *Ceratophyllum*. Verlag von Gustav Fischer, Jena, Germany.

HAYNES, R. R. 2000a. Najadaceae Jussieu. Pp. 77–83 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 22: Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

———. 2000b. Ruppiaceae Hutchinson. Pp. 75–76 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 22: Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

——— AND C. B. HELLQUIST. 2000. Potamogetonaceae Dumortier. Pp. 47–74 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 22: Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

——— AND J. L. REVEAL. 1973. A re-evaluation of *Potamogeton fibrillosus* Fern. (Potamogetonaceae) Rhodora 75:75–77.

HEIDEL, B. 2012. 2012 plant species of potential concern list. April 7, 2012. Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY.Website www.uwyo.edu/wyndd/species-of-concern/plants/index.html (accessed July 2012).

HELLQUIST, C. B. 1980. Correlation of alkalinity and the distribution of *Potamogeton* in New England. Rhodora 82:331–344.

———, R. F. THORNE AND R. R. HAYNES. 2012. *Potamogeton foliosus* subsp. *fibrillosus* (Fernald) R. R. Haynes and Hellq. *in* Jepson Flora Project (eds.), *Jepson eFlora.* Website http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=80561 (accessed 22 Aug 2012).

HOLMGREN, N. H., P. K. HOLMGREN, AND A. CRONQUIST. 2005. Intermountain flora: vascular plants of the Intermountain West, USA. Volume 2, Part B. Subclass Dilleniidae. New York Botanical Garden, Bronx, NY.

KAUL, R. B. 2000. Sparganiaceae Rudolphi. Pp. 270–277 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 22: Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

KESONIE, D. AND R. L. HARTMAN. 2011. A floristic inventory of Grand Teton National Park, Pinyon Peak Highlands, and vicinity, Wyoming, USA. Journal of the Botanical Research Institute of Texas 5:357–388.

LANDOLT, E. 2000. Lemnaceae Gray. Pp. 143–153 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 22: Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

LES, D. H. 1997. Certatophyllaceae Gray. Pp. 81–84 *in* Flora of North America Editorial Committee (eds.), Flora of North America North of México. Vol. 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY.

———, N. M. MURRAY, AND N. P. TIPPERY. 2009. Systematics of two imperiled pondweeds (*Potamogeton vaseyi*, *P. gemmiparus*) and taxonomic ramifications for subsection *Pusilli* (Potamogetonaceae). Systematic Botany 34:643–651.

Lesica, P. 2012. Manual of Montana vascular plants. Botanical Research Institute of Texas, Fort Worth, TX.

Lichvar, R. W., N. C. Melvin, M. L. Butterwick, and W. N. Kirchner. 2012. National wetland plant list indicator rating definitions. U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC), Cold Regions Research and Engineering Laboratory (CRREL), ERDC/CRREL Technical Note 12-1, Hanover, NH.

Marston, R. A. and J. E. Anderson. 1991. Watersheds and vegetation of the Greater Yellowstone Ecosystem. Conservation Biology 5:338–346.

McAlpine, D. F., G. Bishop, O. Ceska, M. L. Moody, and A. Ceska. 2007. Andean watermilfoil, *Myriophyllum quitense* (Haloragaceae), in the Saint John River Estuary System, New Brunswick, Canada. Rhodora 109:101–107.

Mulligan, H. F. 1969. Management of aquatic vascular plants and algae. Pp. 464–482 *in* G. A. Rohlich, A. M. Beeton, D. C. Chandler, W. T. Edmundson, and A. D. Hasler (eds.), Eutrophication: causes, consequences, correctives; proceedings of a symposium, 11–15 June 1967, University of Wisconsin, Madison. National Academy of Sciences, Washington, D.C.

Mulligan, G. A. and J. A. Calder. 1964. The genus *Subularia* (Cruciferae). Rhodora 66:127–135.

Natureserve. 2012. NatureServe Explorer: an online encyclopedia of life (web application). Version 7.1. NatureServe, Arlington, VA. Website http://www.natureserve.org/explorer. (accessed 19 July 2012).

Rydberg, P. A. 1900. Catalogue of the Flora of Montana and the Yellowstone National Park. Memoirs of the New York Botanical Garden, Vol. 1, Press of the New Era Print. Co., New York, NY.

Sculthorpe, C. D. 1967. The biology of aquatic vascular plants. Edward Arnold, London, U.K.

Taylor, P. 1989. The genus *Utricularia*: A taxonomic monograph. Kew Bulletin Additional Series XIV. Her Majesty's Stationery Office, London, U.K.

Taylor, W. C., N. T. Luebke, D. M. Britton, R. J. Hickey, and D. F. Brunton. 1993. Isoëtaceae Reichenbach. Pp. 64–75 *in* Flora of North America Editorial Committee (eds.), Vol. 2: Pteridophytes and Gymnosperms. Oxford University Press, New York, NY.

Thor, G. 1988. The genus *Utricularia* in Nordic countries, with special emphasis on *U. stygia* and *U. ochroleuca*. Nordic Journal of Botany 8:213–225.

Tiner, R. W. 2012. Defining hydrophytes for wetland identification and delineation. U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC), Cold Regions Research and Engineering Laboratory (CRREL), ERDC/CRREL CR Technical Note 12-1, Hanover, NH.

Tweedy, F. 1886. Flora of the Yellowstone National Park. Published by F. Tweedy, Washington, D.C.

United States Department of Agriculture, Natural Resources Conservation Service (USDA, NRCS). The Plants Database. Website http://www.plants.usda.gov/ (accessed January 2012).

Varley, J. D. and P. Schullery. 1998. Yellowstone Fishes: ecology, history, and angling in the park. Stackpole Books, Mechanicsburg, PA.

Wright, J. C. and I. K. Mills. 1967. Productivity studies on the Madison River, Yellowstone National Park. Limnology and Oceanography 12:568–577.

Young, L. (ed.) 2007, Yellowstone Resources and Issues 2007. Division of Interpretation, Yellowstone National Park, Mammoth Hot Springs, WY.